

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U1502

M.E. DEGREE EXAMINATION, DEC 2025

First Semester

Power Electronics and Drives

21PPE102– MODELING AND ANALYSIS OF ELECTRICAL MACHINES

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Summarize Reference-frame theory, commonly used reference frames & Transformation between reference frames. CO1-U (20)
Or
(b) (i) Draw the basic circuit model of 3- ϕ induction motor as well as rotor and obtain voltage equations in terms of stator and rotor currents in the matrix form. CO1-U (20)
(ii) Explain in detail about commutator transformation and also summarize it with respect to 3- ϕ induction motor.
2. (a) Obtain the state space model of a 3- ϕ induction motor with i) Stator reference frame ii) Rotor reference frame. CO2-App (20)
Or
(b) (i) Develop the mathematical model of a dc compound motor in matrix form. Mention why no transformation is required for doing the analysis of dc machines with the help of Keon's primitive machine. (ii) Derive the mathematical expressions for voltage and force/torque from the fundamental principles for
(a) Solenoid with fixed armature
(b) Solenoid with angular movement. CO2-App (20)
3. (a) Explain how flux linkage equations of synchronous machine model can be transformed from stator reference frame to rotor reference frame. CO1-U (20)
Or
(b) Explain Park's transformation for a synchronous machine and develop a mathematical model based on it. CO1-U (20)

4. (a) For a 2 -pole, 3-phase, Y-connected, salient – pole synchronous machine, derive the voltage equations in machine variables and in arbitrary reference frame variables. CO2-App (20)
- Or
- (b) Draw the basic circuit model of 3- ϕ induction motor as well as rotor. Obtain expressions for flux linkages Ψ_a , Ψ_b and Ψ_c of a 3- ϕ induction motor from fundamental equations. CO2-App (20)
5. (a) Derive the expression for armature mutual inductances of a salient pole synchronous machine from a consideration of its basic parameters. CO3-App (20)
- Or
- (b) Apply Park's transformation on a three phase synchronous machine and obtain its voltage and torque equations. CO3-App (20)